WD9EWK's AO-51 V/S Adventure

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For many years, I have been interested in Amateur Radio satellites and have been an AMSAT member. I made a couple of contacts via SO-50 in 2000, plus one contact via UO-14 in 2003, but I did not stay on the satellites. I read about AMSAT's plans for the S-band downlink for AO-51 during the 2005 Field Day, and I ordered a downconverter from K5GNA. I did not have enough time to figure out how to use this downconverter (and, for that matter, make any contacts via AO-51) before Field Day, so I put it away. After reading many posts on the AMSAT-BB mailing list, Drew, KO4MA's, V/S article in the July/August 2005 edition of *The AMSAT Journal*, and – finally – making a serious effort at working the satellites since December 2005, I decided I wanted to try out that downconverter. In early September 2006, I did that. And it was fun!

S-band downconverter.

My V/S Station

The downconverter from K5GNA, a modified TranSystem AIDC 3731 MMDS downconverter, came with an S-band dipole on one end and a corner reflector. I connected it to a Yaesu VX-2R HT and put a power inserter and 6dB attenuator in the RG-6 coax run between the downconverter and the radio. I used an adapter to go from the F connector on the coax to a male BNC connector (along with a BNC-to-SMA adapter, for the VX-2R's antenna connector), not concerning myself with the impedance mismatch between the downconverter and the VX-2R. Of the handheld radios I normally used with satellites (Icom IC-W32A and IC-T7H, Yaesu VX-2R), I could easily disable the transmitter on the VX-2R. A very good thing, to protect the downconverter from accidental RF coming from the receive radio. The VX-2R also had a built-in attenuator, which could be used if the signals from the downconverter swamped the receiver.

For my transmitter, I used an Icom IC-W32A with an Arrow Antennas 2m/70cm handheld Yagi. This is my normal FM satellite station, but for the AO-51 V/S configuration I turned off the 70cm side of the IC-W32A. I left the power level at 5 watts. I had been using the IC-W32A and Yagi to make the majority of my FM satellite contacts since December 2005, so I was very familiar with this combination.

The transmit radio had the standard AO-51 2m FM uplink frequency, 145.920 MHz with 67.0 Hz PL. The receive radio was initially set at 145.250 MHz, which would be approximately equal to the 2401.200 MHz AO-51 downlink frequency and compensating for the Doppler effect at the start of the pass (+50 kHz). I left the VX-2R in VFO mode, since I would be tuning down in 5 kHz steps throughout the pass, and connected an audio splitter to the speaker-microphone jack so I could listen to the pass without causing feedback and record the audio with my Sony digital recorder.

First Attempt

I saw that the V/S voice configuration would be active on AO-51 between 28 August and 3 September and I was determined to make some time to try out the downconverter and – hopefully – log some contacts. The first opportunity I had during that week was Thursday evening (Friday, 1 September, UTC time). There was a pass in the evening to the east, which would cover most of North America, which could provide the best chance to hear other stations and make contacts. I made sure I had my equipment in my car, since I would be out running errands on this Thursday evening. A thunderstorm passed through the Phoenix area an hour before a 39-degree AO-51 pass at 0317 UTC (2017 local time), but the skies cleared enough so I could safely operate my radios.

I parked in a church parking lot in northeast Phoenix (grid DM43ap), and put my radios and antennas on the roof of my car. I planned on holding the IC-W32A and Yagi while transmitting, and then setting the radio and/or antenna down so I could make adjustments to my receive frequency on the VX-2R and turn the downconverter to hear the satellite. About 2 minutes into the pass, I found the AO-51 downlink and could hear a contact in progress. About 2 minutes after that, at 0321 UTC, I made my first V/S contacts with N5UXT in Louisiana (EM40) and WA4EWV in Florida (EM70). Success! The downconverter worked very well, and it was easy to hear AO-51 and keep up with the Doppler through the pass.

If these two V/S contacts were the only two I could make during this week, I would have been happy. I was determined to try again, and hopefully add more V/S contacts to my log before AO-51 switched to its next configuration.

Friday Morning, with Daylight

After the success I had the night before, I took my V/S equipment to work with me. I planned on trying AO-51 during one pass this Friday morning (1 September 2006), a 40-degree pass favoring western North America at 1707 UTC, from outside my office near downtown Phoenix (grid DM33xl). I took a break from my work, and went out to my car to get ready for the pass. It was a sunny morning, and I could hear the AO-51 downlink about 90 seconds into the pass.

The complete S-band setup on top of the car.

I heard other stations making contacts and when there were breaks in the contacts I announced my call sign. In the span of approximately 5 minutes, I made 3 contacts – W7JPI in southern Arizona (DM41), W0LMD in Colorado (DM79) and KU7Z in Utah (DN41). My portable station was working, and I'm hooked! Other than having to constantly keep up with the Doppler effect on the downlink signal, this was getting easier. I was now determined to get on for more passes over the upcoming weekend.

Saturday Morning, from a Park

I was doing some yard work this morning (2 September 2006), missing one AO-51 pass, but I planned to try for a pass around 1807 UTC. This would be a lower pass to the west, with a maximum elevation of 10 degrees, a great test of my portable V/S station. To have the best chance of hearing the satellite, I drove to Paradise Valley Park, a city park north of my house that straddles the DM33/DM43 grid boundary and prepared my station.

Hearing the satellite was surprisingly easy. As long as AO-51 was above 3 or 4 degrees elevation, I could hear the satellite. Unfortunately, I heard no other stations on the downlink. I used this pass to test my ability to transmit through the satellite and hear the downlink. I was disappointed nobody else showed up for this pass, but I knew there were still more passes I could try before the V/S configuration was turned off.

Sunday Morning

I had some free time this morning (3 September 2006), and I was determined to work the two morning AO-51 passes. There was a 32-degree pass to the east starting at 1548 UTC, followed by a 26-degree pass to the west starting at 1727 UTC. I went back to Paradise Valley Park on the DM33/DM43 boundary, set up my portable station on the roof of my car, and waited for AO-51 to appear.

This was a busy pass. I heard several quick contacts at the start of the pass and I was able to get my call sign on the downlink. In a 7-minute span (1550-1557 UTC), I made 7 contacts! I worked W0LMD and KU7Z again, plus 5 others: N8BBQ in Ohio (EN91), W2NBJ in Maryland (FM19), KB0JQO in Iowa (EN32), WA4SCA in Tennessee (EM65) and AI7W in Oregon (CN84).

For the last pass of the morning at 1727 UTC, I operated from my driveway at home (grid DM43ao). I heard W0LMD and KU7Z again, made contacts with both of them and had a nice chat before the satellite went away from us. By now, operating these two separate radio/antenna combinations became easy. I had no problems tuning the receive radio to keep up with the Doppler effect on the S-band downlink.

Observations

I made a total of 14 contacts with stations in 10 US states and 10 grids, from 4 locations in Phoenix. The 2401.200 MHz AO-51 downlink was easy to receive and the Doppler shift was not impossible to deal with despite having my hands full with two separate radio/antenna combinations and no computer control. I sometimes turned the downconverter with its dipole/corner reflector antenna 90 degrees to deal with the changing polarity of the downlink signal. I did not have to point the downconverter directly at the satellite to hear it and at some points I was 45 to 60 degrees away from the satellite and still had a signal in my receiver.

Since this was the first time I tried receiving anything in the 2.4 GHz band I did not know if I would encounter interference from WiFi devices or cordless phones that also inhabit this band. I had no problems hearing the satellite from any of these locations. I was concerned I might cause interference with my receive radio (VX-2R) while transmitting since both radios would be on the 2-meter band separated by a few hundred kHz. This was never an issue. The only way I heard myself was on the AO-51 downlink, not from overloading the receiver with my transmitted signals.

Future Plans

After these passes, I am now a fan of AO-51's V/S FM voice configuration. I will look forward to it showing up on the schedule in the future. This is something I can do from home or almost any other location where I am able to set up my station – on the roof of my car, a picnic table in a clearing, etc. I hope to hear you on V/S!

This is a picture of an historic event for AMSAT. It was the first official meeting between AMSAT, the University of Maryland Eastern Shore (UMES) and the Maryland Hawk Corporation on Tuesday, October 17, 2006 to discuss potential future relationships, including the establishment of a new AMSAT satellite integration lab. The dinner was held in the private dining room of the UMES President and was catered by the students and faculty of the UMES Department of Hotel and Restaurant Management. Front Row, L to R: Richard M. Hambly, W2GPS, AMSAT President; Thelma B. Thompson, Ph.D., President, University of Maryland Eastern Shore. Rear Row, L to R: Dick Jansson, WD4FAB, AMSAT Engineering Team Member; Dr. Robert W. McGwier, N4HY, AMSAT VP Engineering; Dr. Ronald G. Forsythe, Jr., UMES Vice President for Planning, Assessment, Technology and Commercialization; Ron Bettini, Executive Director, Hawk Institute for Space Sciences (a division of the Maryland Hawk Corporation); Dr. Thomas A. Clark, K3IO, AMSAT Director and President Emeritus; Quentin R. Johnson, Special Assistant to the President, University of Maryland Eastern Shore; Robert J. Davis, KF4KSS, AMSAT Engineering Team Member and an employee of Hawk Institute for Space Sciences.